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A global upper atmosphere observatory using of lidar on the International Space Station

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A concept for hosting a lidar facility for the upper atmosphere on the International Space Station (ISS) is presented and discussed. The concept is based on utilizing an existing Large Space Optics mirror having a 2.37-m aperture as the primary mirror in its receiver. This large aperture provides for hosting several transmitter systems to retrieve density, temperature, and wind measurements for several upper atmospheric species. Thus the concept provides for measurements over a wide altitude range (80-600 km), at various time and spatial resolutions, and hosting on the ISS provides nearly global coverage. The baseline concept includes transmitters and receivers for atomic oxygen (80-500 km), metastable helium (400-600 km), and sodium (80-110 km). The facility is conceived as being flexible such that other transmitter/receiver systems could be added to allow the possibility of other species to be studied, such as iron.

The presentation discusses the transformative science that would be gained by such an observatory by combining the nearly global coverage afforded by the ISS orbit with the extension of powerful lidar techniques to high altitudes. The challenges in realizing such an observatory are discussed, as are current plans and partnerships to meet those challenges. The presentation also reports on the development status of several components, primarily various independent transmitter/receiver systems, that are under consideration for the baseline observatory. Several institutions are performing these developments.